

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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# MULTIMEDIA UNIVERSITY

## FINAL EXAMINATION

TRIMESTER 3, 2018/2019

**PEM0016 – ALGEBRA**

(Foundation in Engineering)

31 MAY 2019

9.00 a.m. – 11.00 a.m.

(2 Hours)

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### INSTRUCTIONS TO STUDENT

1. This question paper consists of **THREE (3) pages** including cover page with **FOUR (4) questions** only.
2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided. All necessary working **MUST** be shown.
4. Only **non-programmable** calculator is allowed.

**QUESTION 1 [25 marks]**

(a) Find the real solution of the equation:  $(x^2 - 1)^2 + (x^2 - 1) - 12 = 0$ . (6 marks)

(b) Solve the following inequalities by expressing your answer in interval notation:

(i)  $\left(-\frac{1}{3}x + 9\right)^{-1} > 0$  (3 marks)

(ii)  $-3 \leq \frac{3x - 4}{-2} \leq 6$  (4 marks)

(iii)  $1 - \left|\frac{2x - 1}{3}\right| < -2$  (4 marks)

(iv)  $\frac{x^2 - 9}{x^2 - 49} \geq 0$  (8 marks)

**QUESTION 2 [25 marks]**

(a) Given the following functions:

$$f(x) = \frac{1}{x + A} \quad g(x) = \frac{x}{x - B}$$

Do the following:

(i) If  $f(5)$  is undefined, find the value of  $A$ . (2 marks)

(ii) If  $g(10)$  is undefined, find the value of  $B$ . (1 mark)

(iii) Using the value obtained in (i) and (ii), find the range for both functions. (8 marks)

(iv) Show that  $(f \circ g)(2) \neq (f \cdot g)(2)$ . (5 marks)

(b) An exponential function  $y = a^x - 3$  has the following characteristics:

- Domain =  $\{x : x \in \mathbb{R}\}$  and Range =  $\{y : y > -3\}$
- Contains points:  $(0, -2)$ ,  $\left(1, -\frac{14}{5}\right)$  and  $(-1, 2)$

Do the following:

(i) Determine the value of  $a$ . (4 marks)

(ii) Sketch the graph of the function. (3 marks)

(iii) Check whether the function has vertical/horizontal/slant asymptote. (2 marks)

**Continued.....**

**QUESTION 3 [25 marks]**

(a) The polynomial  $6x^3 + 7x^2 + ax + b$  has a remainder of 72 when divided by  $(x - 2)$  and is exactly divisible by  $(x + 1)$ .

- (i) Calculate  $a$  and  $b$ . (6 marks)
- (ii) Show that  $(2x - 1)$  is also a factor of the polynomial. (2 marks)
- (iii) Obtain the third factor. [*Hint*: Use synthetic division.] (4 marks)
- (iv) Sketch the polynomial function. Label coordinates for all real zeroes and y-intercept. (5 marks)

(b) Express  $\frac{5x^2 - 2x - 1}{(x + 1)(x^2 + 1)}$  in partial fraction. (8 marks)

**QUESTION 4 [25 marks]**

(a) Find the matrix,  $(AB)^{-1} - C^T + I$ , if the matrices are defined as

$$A = \begin{bmatrix} 1 & 3 & -3 \\ 3 & 0 & 5 \end{bmatrix}, B = \begin{bmatrix} 3 & 0 \\ -3 & 1 \\ 0 & 5 \end{bmatrix}, C = \begin{bmatrix} 2 & 3 \\ -4 & 1 \end{bmatrix}$$

(10 marks)

(b) Apply the Cramer's Rule to solve the following system of equations.

$$2x + 3y - z = 15$$

$$4x - 3y - z = 19$$

$$x - 3y + 3z = -4$$

(15 marks)